Critical Materials Institute

AN ENERGY INNOVATION HUB

What is the problem?

Actual or threatened shortages of essential raw materials create risks for U.S. manufacturing and energy security. Nascent industries, including the clean energy sector, are particularly vulnerable.

Critical materials (*a*) provide essential and specialized properties to advanced products or systems, (*b*) have no easy substitutes, and (*c*) are subject to supply risk.

Rare earth elements emerged as critical materials in 2010, with their essential roles in high-efficiency motors, generators and advanced lighting, lack of supply diversity, and growing demand. Rare earth metals and alloys are not produced in the United States despite the availability of geologic resources, because the processes required to separate individual rare earths from one another and then convert them to metals and alloys are inefficient, costly, polluting, and potentially damaging to worker health and safety.

Other critical materials have emerged in recent years, including cobalt, gallium, indium, lithium, manganese, platinum group metals, tellurium, vanadium, and battery-quality graphite.

In every case, the solution is innovation throughout the supply chain.

What is CMI's mission?

To assure supply chains of materials critical to clean energy technologies—enabling innovation in U.S. manufacturing and enhancing U.S. energy security.

How will CMI secure the supply chains of critical materials?

By *developing*, *demonstrating*, and *deploying* technology (*a*) to diversify and expand the availability of these materials throughout their supply chains, (*b*) to reduce wastes by increasing the efficiency of manufacturing and recycling, and (*c*) to reduce demand by identifying substitutes for critical materials. In all three areas, the needs of U.S. manufacturing drive CMI's research agenda. From the outset, every project has a commercialization plan.

What has CMI accomplished so far?

After nearly five years of work, CMI has published over 200 refereed publications in leading scientific journals. It has issued 75 invention disclosures, 40 patent applications, 5 technology licenses, and 2 open-source software packages. It has received 4 patents and two R&D 100 Awards. Some of CMI's inventions are already in commercial use.

What will CMI do next?

The Institute's industrial collaborators are working to incorporate its accomplishments in their products and processes, across all three of the areas described above – source diversification, materials substitution, and improved stewardship of existing resources.

In its second five years, CMI will apply the valuable lessons learned so far to address a wider range of materials and technologies. It will:

- Engage a wider range of industrial partners.
- Address emerging critical materials through world-leading early-stage applied research.
- Provide the leaders, technical experts and skilled professionals needed by U.S. industry to assure its supply chains.
- Become a self-sustaining entity by the end of its tenth year of federal support.

Who are the partners in CMI?

Led by the Ames Laboratory, in Iowa, CMI consists of 350 scientists, engineers and support staff at four national laboratories of the U.S. Department of Energy, seven universities, and eleven industrial partners. The leadership team comes from six of these institutions, and they manage CMI's geographically dispersed labs as if they were a single organization.